IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Lee D. Saathoff et al.
Application No.:	10/788,732
Filing Date:	February 27, 2004
Confirmation No.:	6113
Title:	POWER TRANSMISSION FLUIDS
Examiner:	James C. Goloboy
Group Art Unit:	1797

DECLARATION OF LEE D. SAATHOFF

Mail Stop AMENDMENT
Commissioner for Patents
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Alexandria, VA 22313-1450

Sir:

I, Lee D. Saathoff, hereby declare as follows:

1. I am presently employed by Afton Chemical Corporation, Richmond, Virginia, as an Engineering Specialist. I have over 4 years of experience in the area of transmission lubricant research with Afton Chemical Corporation (formerly Ethyl Corporation). Prior to my employment with Afton Chemical in Driveline Lubricants, I have an additional 30 years at Afton Chemical Corporation.

2. I graduated from Southern Illinois University in Edwardsville, Illinois in 1989 with a Bachelor of Science degree in Electrical Engineering.

3. I am the author, or co-author, of 2 papers in reviewed Journals, relating to gear and transmission lubricants, and am an inventor on 2 U.S. Patents.

4. I am a named inventor of U.S. Application No. 10/788,732. I have read the specification and claims and am familiar with the application.

5. We have surprisingly found that a tertiary amine where R_1 comprises an alkyl or alkenyl group having about 1 to 4 carbon atoms and R_2 and R_3 independently comprise one of an alkyl, an alkenyl, an alkynyl, an alkylthioalkyl, a haloalkyl, and a haloalkenyl group having from about 8 to 30 carbon atoms provides significant advantages over other tertiary amines when utilized in a power transmission fluid. For

example, it has surprisingly been found that the presently claimed transmission fluids can be used to control friction properties for longer periods of time than transmission fluids containing other tertiary amines.

In addition to the data submitted in the Declaration signed August 7, 2009, we conducted additional testing on four fluids to demonstrate improved performance over the claimed wt% range of aliphatic tertiary amine. The data is included and explained below.

Four transmission fluid formulations, were tested in the LFW-1 friction test (explained in detail at page 15 of the present specification). Two example inventive fluids (Ex. 1 and 2) that contained a tertiary amine having one methyl group and two long-chain groups were tested at 1 and 5 wt% of the tertiary amine. Two comparative example fluids (Ex. 3 and 4) that contained a tertiary amine having two methyl groups and one long-chain group were tested also at 1 and 5 wt% of the tertiary amine. The test sample formulations and test results are disclosed in the tables and figures below:

Test samples	Ex. 1	Ex. 2	Ex. 3	Ex. 4
Tertiary Amine R1 = 1 C R2 = 12-14 C R3 = 12-14 C	1.0	5.0		
Tertiary Amine R1 = 1 C R2 = 1 C R3 = 18 C			1.0	5.0
Dispersant ~950 MW PIB based dispersant[1]	4.0	4.0	4.0	4.0
Base Oil Yubase 4[2]	89.60	89.60	85.60	85.60
Other Typical Transmission Fluid Additives	Balance	Balance	Balance	Balance

[1] ~950 molecular weight polyisobutylene based dispersant having no boron or phosphorus.
[2] Yubase 4 is a group II/III base stock with viscosity of about 4.2 cSt at 100 °C

Test Results	Ex. 1	Ex. 2	Ex. 3	Ex. 4
New				
Static coef	0.2147	0.2066	0.1989	0.1700
Dynamic coef	0.1947	0.1921	0.1921	0.1789
Static/Dynamic	1.1026	1.0757	1.035	0.9504
Init max pt	0.2182	0.2093	0.202	0.1783
Final max pt	0.2189	0.2107	0.2022	0.1781
Aged 100hrs at 170°C				
Static coef	0.1924	0.1705	0.1899	0.1679
Dynamic coef	0.1891	0.1763	0.186	0.1798
Static/Dynamic	1.0174	0.9668	1.0207	0.9336
Init max pt	0.1960	0.1759	0.193	0.1786
Final max pt	0.1963	0.1767	0.1934	0.1787

The formulations were each tested before aging and after aging, identified as "New" and "Aged", respectively, in the graphs inserted into the text below. Measurements of friction characteristics were taken at the start of the test when the ring was stationary (the left-hand side of the graph) and as the ring gradually accelerated to its maximum speed (about 0.5 m/s in the center of the graph) and as the ring gradually decelerated back to zero (the right-hand side of the graph).

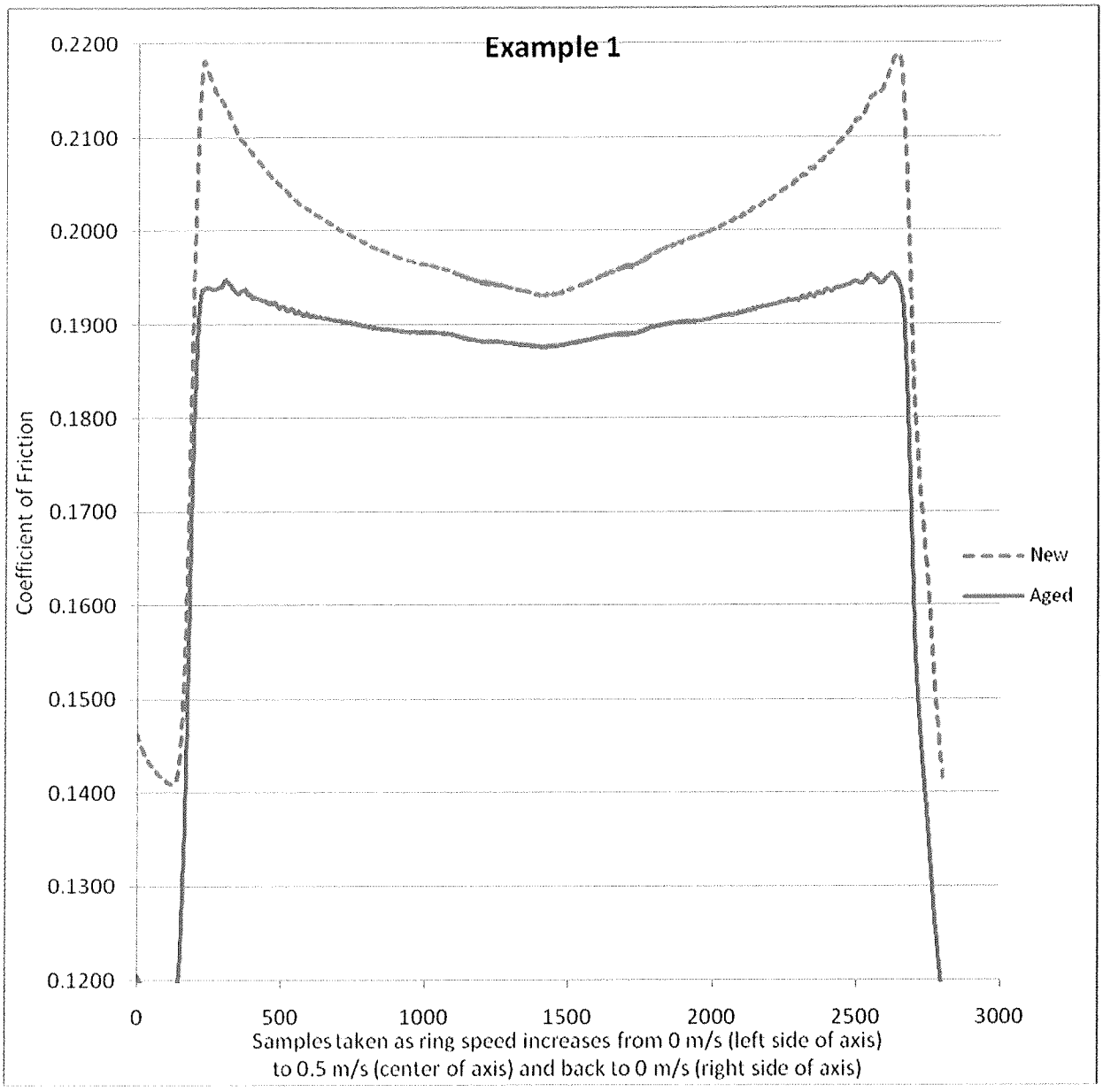
In order to assess the difference between the tertiary amine including a single methyl group and the tertiary amine including two methyl groups, the ratio of static to dynamic friction was calculated for each run.

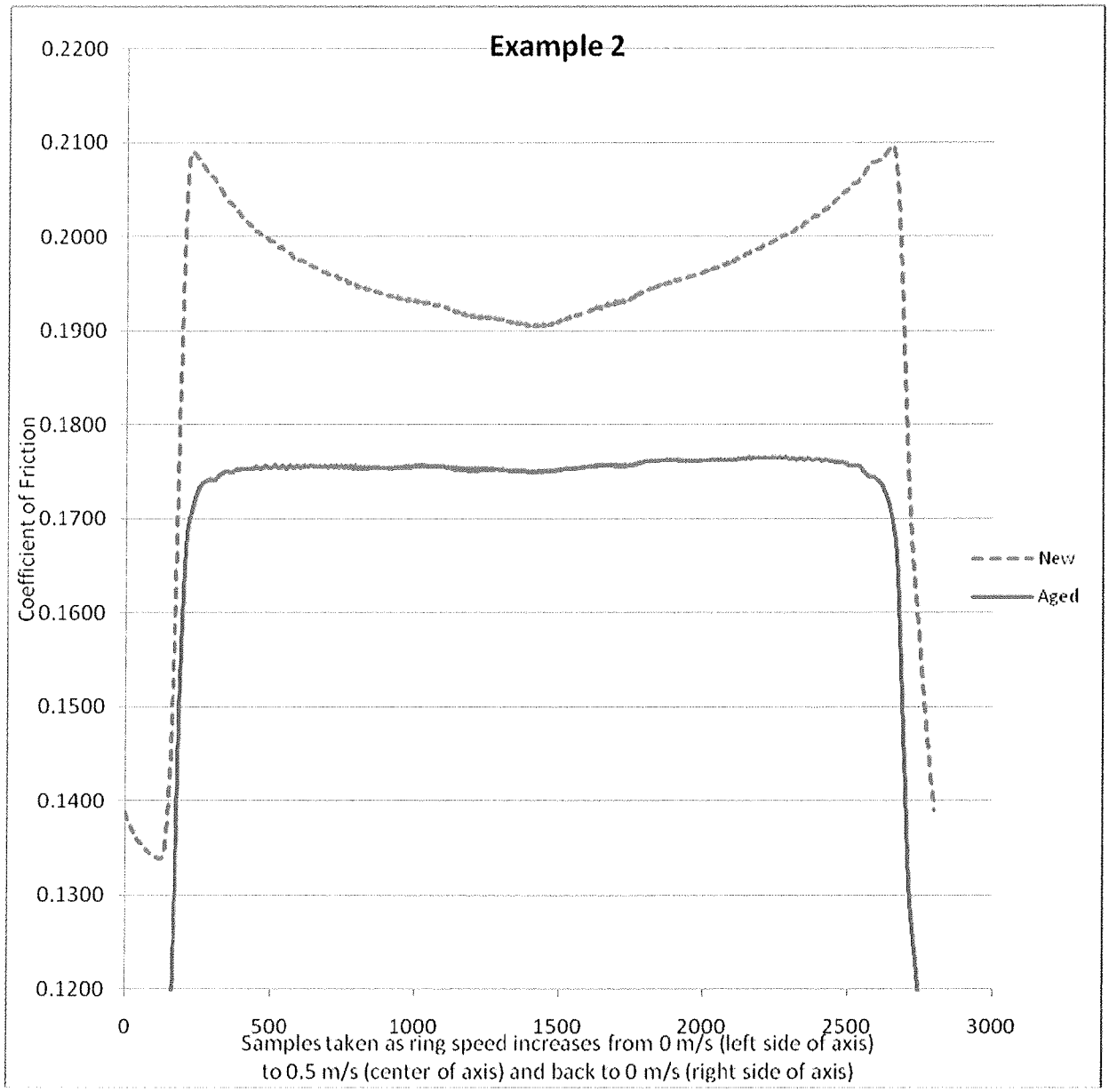
A difference of about 6% was found between the "New" formulation containing 1.0 wt% of a tertiary amine having one methyl group (Example 1) and the "New" formulation containing 1.0 wt% of a tertiary amine having two methyl groups (Example 3). A difference of about 12% was found between the "New" formulation containing 5.0 wt% of a tertiary amine having one methyl group (Example 2) and the "New" formulation containing 5.0 wt% of a tertiary amine having two methyl groups (Example 4). A difference of less than 1% was found between the "Aged" 1.0 wt% amine formulations (Example 1 vs. Example 4), and a difference of about 3% was found between the "Aged" 5.0 wt% amine formulations (Example 2 vs. Example 4).

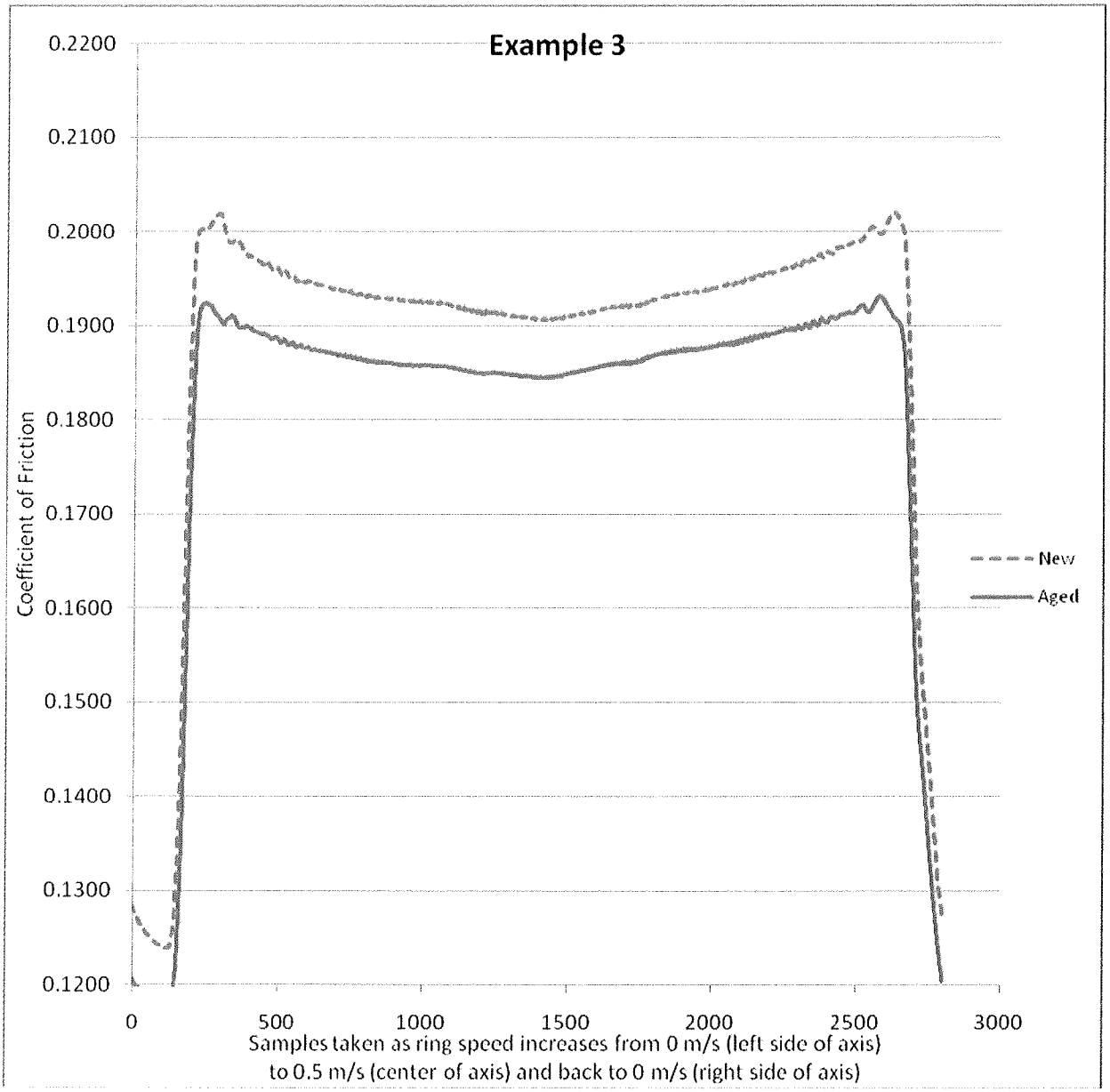
Further, as is apparent from viewing the Figures, the difference in static to dynamic friction ratio of the inventive fluids is greater for new and aged when compared to the difference in static to dynamic friction ratio for new and aged of the comparative fluids at equivalent treat rates (i.e., in the inventive fluid figures, this effect is shown, for example, by a greater difference in static friction between the new and aged fluids when compared to the small difference in static friction between the new and aged fluids of the comparative fluid. Further, the dynamic friction of the inventive fluids changes from a dip to a plateau as the fluid ages. This is desirable. In the comparative fluids, the change is much less pronounced. The new and aged fluids are very similar in performance, which indicates little change). Such change between new and aged fluid performance demonstrates the benefits of the presently claimed invention. As a power transmission fluid ages, friction modifiers degrade and/or deteriorate, losing their ability to provide friction control. Typically, once the friction modifiers in a transmission fluid lose the ability to provide satisfactory friction control, it must be replaced. However, it has been found that by including tertiary amines in transmission fluids in sufficient amounts and of the type presently claimed, the transmission fluid continues to effectively control friction properties longer than other transmission fluids. The present data demonstrates this since as the inventive fluid ages, the static to dynamic friction ratio shows a more significant decrease than the comparative formulation. The tertiary amines according to

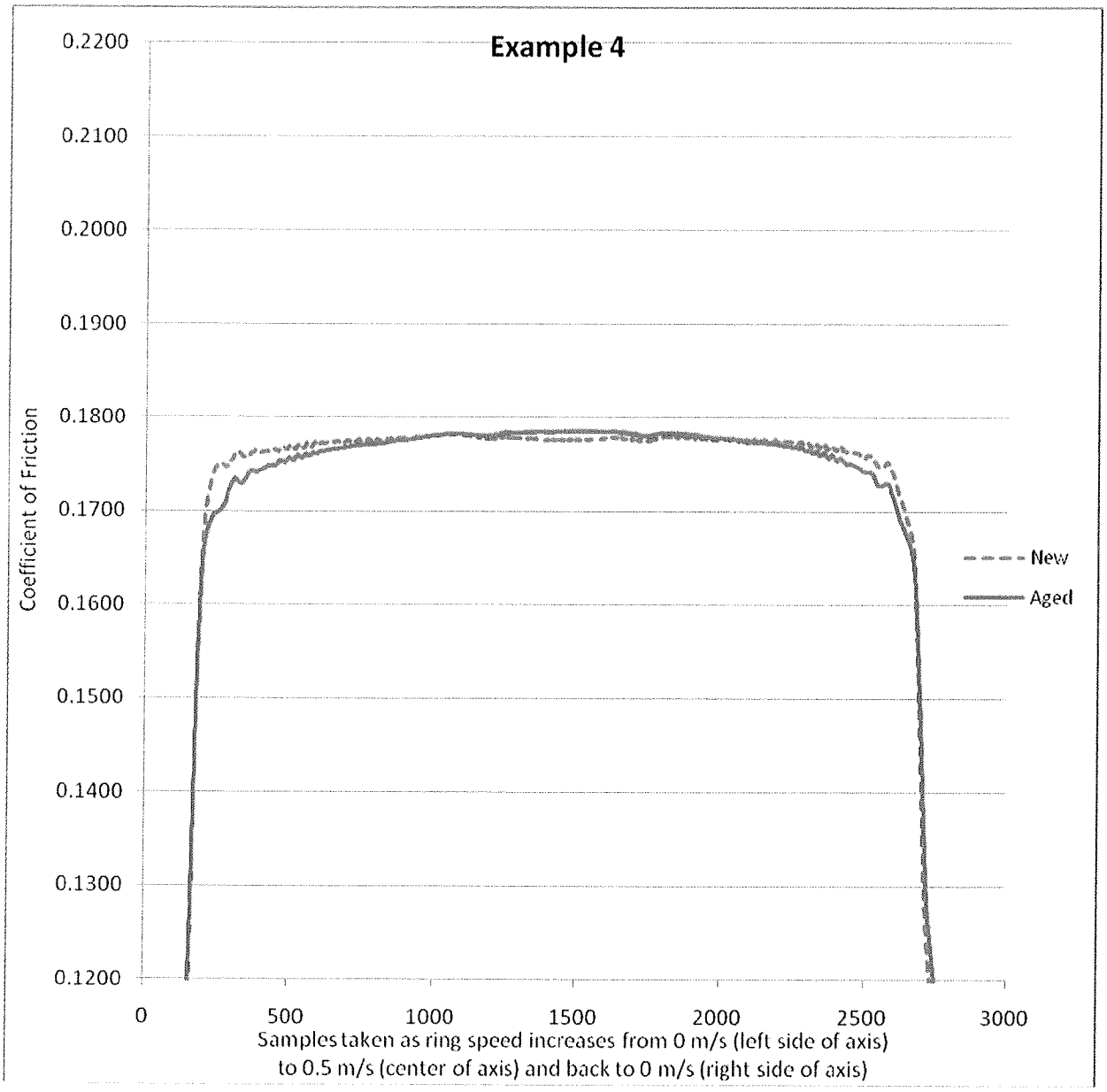
the presently claimed invention, do not significantly affect friction initially, but become increasingly effective as the fluid ages and the friction modifiers degrade and/or deteriorate.

Accordingly, there is a difference between the tertiary amines, and the selection of a tertiary amine as defined in the present claims does bring about an unexpected technical effect.




Example 2
0.2200
0.2100
0.2000
0.1900
0.1800
0.1700
0.1600
0.1500
0.1400
0.1300
0.1200
Coefficient of Friction
0
500
1000
1500
2000
2500
3000
Samples taken as ring speed increases from 0 m/s (left side of axis)
to 0.5 m/s (center of axis) and back to 0 m/s (right side of axis)
New
Aged


Example 3
0.2200
0.2100
0.2000
0.1900
0.1800
0.1700
0.1600
0.1500
0.1400
0.1300
0.1200
Coefficient of Friction
0
500
1000
1500
2000
2500
3000
Samples taken as ring speed increases from 0 m/s (left side of axis)
to 0.5 m/s (center of axis) and back to 0 m/s (right side of axis)
New
Aged



9. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

4-1-10

Date

Lee D. Saathoff

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